

A LECTURE

16

ON THE

MANIFESTATIONS OF ALMIGHTY POWER,

DELIVERED BEFORE THE

HARRISBURG LITERARY INSTITUTE,

TUESDAY EVENING, APRIL 13, 1852.

BY CHARLES C. BOMBAUGH.

"All are but parts of one stupendous whole,
Whose body Nature is, and God the soul—
Which changed through all, is yet in all the same;
Great in the earth as in th' ethereal frame;
Warms in the sun, refreshes in the breeze,
Glows in the stars, and blossoms in the trees."—POPE.

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1852.

CORRESPONDENCE.

HARRISBURG, April, 22, 1852.

CHARLES C. BOMBAUGH,

Dear Sir:—The undersigned having been present at a recent meeting of the Harrisburg Literary Institute, and having listened with great pleasure to your able address on the “Manifestations of Almighty Power,” herewith take occasion to respectfully solicit, for themselves and numerous friends, a copy of said address for publication. Trusting you will grant our request, we remain,

Very respectfully, Yours, &c.

GEO. B. AYRES,

F. C. CARSON,

J. M. BECK,

JAS. FLEMING,

GEORGE A. C. SEILER,

WM. H. EGLE,

GEO. DOCK,

R. A. LAMBERTON,

S. D. INGRAM.

April 24th, 1852.

Gentlemen:—In reply to your courteous note of the 22d, I have simply to say that though willing to accede to the request with which you have honored me, for the sake of impressing upon your minds the truths to which you listened so attentively, and which you have deemed worthy of reperusal, yet I trust that you will be ready to overlook many imperfections in the lecture, inasmuch as it was not written with a view to publication.

Your obedient servant,

CHAS. C. BOMBAUGH.

Messrs. Ayres, Carson, Beck, Ingram, Seiler, Egle and Lamberton, Drs. Dock and Fleming.

LECTURE.

GENTLEMEN :—I have chosen the subject to which your attention is invited for a brief period this evening, not with the expectation of being able to say much that will be instructive or new to you. To unfold the works of Creation and Providence in such a manner as to give anything approaching an adequate idea of the wisdom and power displayed in the wonderful adaptation of parts to each other, and the admirable combination of means for the attainment of ends, would require not only a long series of lectures instead of one, but the ability of a life time devoted with unwearied assiduity to the investigation of those works. For myself, I am yet but little further than the outset. Nature has conducted me but a little way into her penetralia, revealed but few of her mysteries, and but faintly disclosed the traces of design in her operations. My object will therefore be (since it is the most that I can do), rather to suggest to you topics for reflection than to offer descriptions of things and follow out trains of reasoning, and also to recall to your minds many things with which you have been familiar from early years, but to which it is very questionable whether you have ever devoted that amount of serious thought which they so eminently deserve.

It was beautifully said by Plato more than two thousand years ago, that

"The world is God's epistle to mankind."

This epistle is always lying unfolded before us. It is our grateful privilege to read it whenever we will, and if we fail to cultivate those faculties that will enable us to read it with a just appreciation of its wondrous merits, ours is the fault, and ours must be the loss. The boundries of nature are open and free to all alike, and therefore should I chance to present anything that will be new to you, it will be merely because I have occasionally lingered by the wayside, to inhale the fragrance of flowers that in your energetic fulfilment of the active

duties of life, you have passed unnoticed, and because I have sometimes stopped to listen to the harmonies of a lyre upon whose strings your fingers have often rested, yet perhaps, seldom attended.

Where, then, shall we find these manifestations of Almighty Power—these evidences of omniscience—these tokens of infinite wisdom—these indications of a handiwork as far above all human ingenuity as the brilliant light of heaven's luminary is superior to the flickering beams of the taper? We need not wander beyond the confines of our own sublunary sphere to search for them in the planetary worlds that are ceaselessly revolving the illimitable paths of space. We need not merely seek them in those forms of matter that are "to us invisible, or dimly seen,"—seen "through glass—darkly." They are above, around, beneath, yea even within us. We ourselves are living memorials, breathing witnesses of this immeasurable power, this incomprehensible wisdom. And when we turn from the contemplation of ourselves to the objects of creation around us, we see the power manifested in a thousand ways, for

"To him, who, in the love of Nature, holds
Communion with her visible forms, she speaks
A various language."

Wherever we go and under whatever circumstances we are placed, we are made aware of her presence by the perceptions of *all* our senses. We may see its manifestations in the landscape as it stretches beyond us to the horizon with its unending variety of hill and valley, of plain and mountain, of placid lake and noisy waterfall, when they are reflected by the glorious light of day by the paler, softer radiance of the moon. We may see them in the successive changes of the seasons as we contrast the blossoms of spring and the harvests of autumn, the verdure of summer and the frosts of winter. We may see them in the numberless variations of each climate, as we re-

from the everlasting snows of Lapland to the burning sands of Sahara, from the adamantine bergs of the Arctic to the liquid fire that streams from Cotopaxi. We may see them as well the diminutive acorn as in the mighty oak; as well in the lowly floweret as in the majestic palm; well in the humble insect that a breath might crush as in that

"Leviathan, which God of all his works
Created hugest that swim the ocean stream;"
easily in the little sparrow that chirps by the hedge as in the eagle that soars away to the sun and gazes with unblenching eye upon its full meridian splendor; as clearly in the sparkling sand on the sea shore as in the mighty rocks that bear on their rugged forms the impress of ages. We may see them in the lightning's glare, the earthquake's shock, the rage of the tempest, and the visitation of the pestilence. Turn where we may, h

"In the vast, and the minute we see
The unambiguous footsteps of the God
Who gives its lustre to an insect's wings,
And wheels his throne upon the rolling worlds!"
We may hear these manifestations when heaven's artillery is scattering its thunderbolts about, when peal after peal announces the progress of the great cannonade. We may hear them in the ceaseless roaring of Niagara's waters as they are led with resistless fury into the foaming gulf below; in the fearful dashing of old ocean, when billows are rolling mountain high, or in its holmoeaning, when less tumultuous, and yet not unquiesced, it seems to "sigh for the inland quiet waves can never reach." We may hear them in the startling reverberations of our own voices when we stand within the darksome walls of some cavernous depth excavated by the hand of Nature in one of the many hills that form her vast domains. We may hear them in the gentle murmur of the rivulet and the musical whisperings of the summer breeze, or in the howlings of the great hurricane: when our listening ears are enraptured by the nightingale's sweet tones, or when we tremble at the lion's roaring.

Then we have the evidence of *taste*. We may see them in the kindly fruits of the earth so bountifully produced for our nourishment and our enjoyment; in the pure waters of the crystal fountain; in the purple juice that God intended for better purposes than those to which Bacchanalian excess has devoted it; in every substance that presents in turn its own peculiar flavor, sweet or sour, pungent or bitter, aerid or oleaginous, saline or alkaline, to subserve its own peculiar purpose. And what a variety of odors are ever affecting our sense of *smell*! What fragrance is exhaled from flowery fields ere the morning dew has passed away; from the odorous gales that are wafted from the blossoms of the early spring; the balmy

breath of orange groves and the spicy woods of the Indian isles; the violet that lifts its modest head by the way side, and the queenly rose, the pride of a lady's parterre; the aromatic herbs at the new mown hay, far sweeter than incense offered at the shrine of idolatry.

And lastly, we have the evidence of *feeling*. The outward sense of touch will tell the heart within how much there is in the warm pressure of the hand and lips of those we love; it will tell us how soft is the downy breast of the eider, but how keen the insect's sting; how delicate is the texture that enshrouds the silk worm while a chrysalis, but how sharp the serpent's fang. We may feel the influence of this power stirring the soul within us when we stand alone amid the solemn silence and the heavy shadows of primeval forests; when we are cheered by the sunshine that gladdens all smiles upon, or when we are depressed by the gloom that pervades nature when the sky looks frowningly, and darkly gathers the storm; when the morning light allures us abroad to enjoy the freshness of the air upon the hills, and when the evening twilight invites to meditation; when we gaze from the brink of a fearful precipice with the consciousness that a single step further will dash us to pieces in the abyss beneath, or when we sail upon the broad surface of the sea, calm or tempestuous, and reflect that there is but a frail bark between us and eternity. We may feel it again in the strength and vigor that our daily aliment imparts when we are enjoying that "boon which makes it life to live," or in the fatal course of the deadly poison, as it traces its way with unerring certainty to the sources of vitality, stamping with out, a pallid hue, and leaving within, a pulseless heart; we may feel it when the blood flows warmly through its channels, and we arouse the mighty slumbers in our arm, that we may go forth and enact our part in the great theatre of life, or when the silver chord is loosening, the last scene of our eventful history closing, and the curtain about to drop and shut us from the world forever.

Such are a few of the vast infinitude of forms in which these manifestations are presented to us. I have included more, perhaps, than our time will admit of, yet if they will serve to remind you of the immense resources with which the great laboratory of nature is supplied, and from which she is producing objects that are ever new, ever varying, ever attractive, the time has not been misspent.

I have said that we bear in our own persons exemplifications of this Almighty Power. We are full of wonders. We are walking mysteries, inexplicable to ourselves. Every one of us is a microcosm,—a little world in his own person. But how few of us are there who do not live from day to day, in seeming, if not real ignorance of the

act. A well executed and ingenious piece of mechanism, such as a watch, an automaton, or a steam engine, will often arrest our attention and call forth expressions of the warmest admiration, and yet in all of them together, there is not a tithe, no, nor a shadow, of the ingenuity that is displayed in the construction of one right arm. There you will see the very *ne plus ultra* of mechanism, the "instrumentum instrumentorum." To be convinced of this, you have only to contemplate its capabilities, and analyze its structure. You will see in it a design as exquisite as it is curious; you will observe that every part is precisely adjusted to its office; that its sensibility is exceedingly delicate and its symmetry faultless; that its actions are powerful, and its movements easy and graceful. From the innumerable variety of these movements the hand alone is capable of executing, it must necessarily be exceedingly complex in its structure, and yet, although it is in constant use, how seldom, if ever, does it enter our thoughts that we are using an instrument of such complexity. This unconsciousness may arise from the very perfection of the instrument, for if what is said of dress be true, —that its perfection consists in such neatness and adaptation to the wearer, that after we have left the company of individuals arrayed in accordance with true taste, we are entirely unable to give anything like a satisfactory description of their personal appearance,—our insensibility to the uses of the hand might be explained on the same principle. But be this as it may, much depends on habit. A childlike fondness for novelty is implanted in all of us—for we are but children of a larger growth—and we would give more consideration in one hour to the workings of the fingers of one of Maelzel's life-like figures than we ever did to our own fingers in the whole course of our lives; in other words, admire and applaud a faulty imitation, rather than the real object itself, because, forsooth, we have always been accustomed to the latter.

But let us devote a brief portion of our time to a rapid examination of this elegant piece of workmanship. We find that it is made up of a series or framework of levers. These levers are composed of bone, a substance containing just sufficient of the phosphate and carbonate of lime to render them firm and solid, and capable of resisting stretching, compression and torsion, and just sufficient gelatine to prevent their being brittle and give them the requisite degree of toughness. Moreover, they are hollow cylinders, a form that unites the utmost strength with the greatest possible lightness. Then they are connected by joints or articulations, and these are strengthened and the bones firmly held together by means of ligaments which are fibrous bands or cords combining flexibility with toughness. But these joints, like the

wheels of machinery, would wear out from constant friction, if they were not oiled. There is therefore, placed between them a serous sac, which is called a synovial membrane, and which secretes an albuminous fluid to prevent attrition. The synovia is so far superior to the ordinary oils for the purpose of lubrication, that if any one could devise an artificial process for manufacturing it, it would be entitled to a vote of thanks from the railroad companies and machinists. We find in the arm on further examination, different kinds of articulations to answer the purposes for which they are severally intended. Its connection with the shoulder is a ball and socket, constituting a universal joint by means of which, as any one may see in his own person, the arm may at pleasure be elevated or depressed, extended forwards or backwards inwards or outwards. When we come to the elbow, we see a joint that is not capable of effecting so many movements, but which is more complex in its character. There are two bones in the forearm, the ulnar and the radial, and but one, the humeral, coming from the shoulder. Now the ulna is attached to the humerus in such a manner as to form a hinge joint, enabling us to flex the forearm or to extend it as we wish, while the radius, which the hand and wrist are attached, is so placed that it may rotate upon the ulna, carrying, or rather rolling the hand from its dorsal to its palmar surface and back again, without aid from the shoulder joint, or interference with it. It is this wonderful combination of two, or properly speaking, four entirely different motions that endows the arm with that facility of operation so peculiar to itself. Of the movements capable of being effected by the eight bones of the wrist and the nineteen bones of the hand, it is needless to specify. Daily familiarity with their use will teach you better than words can, if you will but listen to the teachings. Suffice it to say, in this connexion, that we can by means of all these levers not only perform an infinite variety of actions, but perform them at such an astonishingly rapid rate that it is impossible for the mind to keep pace with them. This cannot be said of a machine, for when we understand the modes operandi of a machine, a steam engine, for example, —you can see its workings at a glance. You know, too, that the practical applications of any one machine, are at no time but limited, while everything we see around us that gives evidence of the progress of art, if it is directly, is at least remotely, the result of manual labor. But these levers must have flexor and extensor muscles to put them in motion, and this purpose is answered by those fleshy masses called muscles. These possess the remarkable and characteristic property of contracting under the influence of stimuli, and of course, relaxing under their deprivation. There is much in their arrangement

worthy of attention. Wherever we find a muscle to execute a particular movement, we shall find either to antagonize and move in the opposite direction. We see their number, too, dependent upon their functions, there being, for example, two common flexors for the fingers, because the fingers are generally used in a state of flexion, while there is but one common extensor, as we have but little use for the back of the hand, and its principal duty is to extend the fingers in opening the hand. We see the thumb more largely supplied with muscles than any single finger, because it is the opponent of all the fingers. There is also observable in their arrangement a regard to symmetry, care being taken that at those points where a muscle, if in a state of flexion, would necessarily produce an unsightly and awkward bulge, that it shall be tenuous. You see these tendons or sinewy cords, for instance, in the wrist and hand, while the muscles which pull them are placed in the arm. But let us get a step further. These muscles have no motive power of their own; they can only act in accordance with the *will* of the individual, and though this will may be so instantaneous that he is unconscious of it, yet it is none the less an act of volition. Now as this will resides in the brain, how can its wishes be communicated to the muscles? It is done by means of a minute system of graphic wires called *nerves*. There is a set of motor nerves extending to every muscle, over which despatches from the brain are being constantly sent. But at our next step, it will occur to you reasoning from analogy, that these muscles cannot be in constant exertion without wearing out. Every muscular exertion is attended with a waste of its tissue, and how is this loss repaired? It is done by imbibing from the blood, which is the great "pabulum vitæ," those nutritious portions which the tissue can assimilate to its own structure. But how does the blood get there? It is sent by the expulsive power of the heart, aided by other forces, through a set of vessels called arteries. Then it may be asked, what becomes of the remaining blood which is unfitted for nutrition? It is sent back through the veins to the right side of the heart, and thence into the lungs, where it takes up its injurious carbon, receives life-sustaining oxygen from the air that is breathed, and again coming arterial, it is distributed from the left side of the heart to every part of the system in as little time as it has taken me to tell you. As to the origin of the blood itself, it need scarcely be added that it is derived from the chyle, a fluid which is formed from the nutritious portions of the food we eat, by the exceedingly interesting and complicated process of digestion.

Passing still further in our examination, we shall find beside the motor nerves already spoken of a system of sensory nerves whose object is to

communicate to the brain sensation or feeling, and which in the ends of the fingers, we observe developed into the sense of touch,—a sense which can be educated to an astonishing degree of acuteness, as may be seen in those who are deprived of sight. For the various offices that yet remain to be fulfilled, we find periosteum investing the bones, fascia covering the muscles, cellular tissue and fat occupying intervening spaces, and other things of which want of time renders a notice here impossible. There is enough in the structural arrangement of the integument or skin which invests all this machinery, alone, to form the material for a lecture. Sufficient has already been said to give you a general idea of the arm, as a piece of mechanism. You will see, too, how intimate are its relations with the rest of the system, and particularly the three great functions of life, innervation, circulation and respiration. It is by the brain, by the heart, and by the lungs that we live. They constitute, therefore, a tripod upon which life stands, and if one of the feet is knocked away by disease or injury, the others must fall with it.

I might add, before leaving the arm that in order more fully to appreciate the wisdom shown in its formation, its functions should be carefully considered and compared with those of the foot. Then by comparing their corresponding differences in structure, you will be struck with the highest admiration at the wise provisions in each for the performance of duties so entirely different.

I have directed your attention to this part of the human frame, not because of any innate superiority over other members and organs, but simply as an illustration of the design evinced in all. My favorite illustration of writers on Natural Theology is the *eye*, and to them I refer you for an interesting description of this perfection of optical instruments. But do not confine your readings to the mere eye-ball itself. Study its appendages, for without these it would be of little use. They are like the various fixtures to a telescope. The eye of a telescope, which is its object glass, may have had an ample fortune expended upon it in return for the years of arduous labor spent in giving it perfect polish and the proper convexity, yet alone it is of no service. The image it refracts is formed in the tube of the telescope, and this image must be viewed through a magnifying glass called the eye glass. Then, the instrument, however ponderous, must be placed in connection with such machinery as will enable one man to change its position and point it to any quarter of the heaven. But the observatory,—which, it should be noticed, is constructed expressly for it,—must be covered by a dome, and in order that the opening in the dome may conform to those changes, it should be wheeled around with ease, though it weigh several tons. Then again, in consequence of the revol-

ion of the earth, the field of vision is constantly changing. Now if the observer had to be shifting his instrument all the time, and to be making his calculations besides, his task would be intolerable. To prevent such interruption, therefore, there must be a clock work apparatus whose movements will correspond with the rotatory motion of the earth, and keep the star precisely in the axis of vision. But the instrument might be jarred by the rolling past of vehicles, if a street is near, or by other causes. It must consequently have a base firm enough to resist all concussion, and for this purpose, huge masses of granite must be piled upon one other, thirty or forty feet in depth. Thus it is with the eye, for besides the inherent powers of the globe itself, such as its capability of adaptation to different distances, whether a few inches or several miles; the contraction or dilatation of the pupil, according to the brightness or dimness of light; and the absence of spherical and chromatic aberration, in other words, the haziness and false colors, from which no artificial optical instruments are ever free,—it must be provided with sufficient muscles to move it in every direction in its orbit with facility; it must have a lid to protect it from injury, to close it in sleep, and to spread over it in the act of winking, a lotion to moisten and cleanse it; it must be furnished with a lachrymal apparatus, not only to supply this lotion,—which forms tears when the gland is stimulated to active secretion by strong emotion,—but to convey it away through a duct in the nose, on the inner walls of which it is evaporated by the warm currents of air that pass over it in the act of respiration,—a contrivance for which we ought to be very thankful, for otherwise, we should be weeping all the time.

If you become familiar with the structure and functions of the eye, study those of the ear, of the mouth, of the heart,—study the *whole* system. Become acquainted with every compartment of the “house you live in.” Surely you cannot devote your leisure hours to a theme that is more highly interesting, more instructive, and more—I do not add, *essential*, for a man may outlive the allotted three score and ten, without knowing why the food he swallows does not go into the lungs instead of the stomach, or without ever dreaming for what purpose his eyebrows were given to him—but I do say, *profitable*,—profitable, if for no other reason than to enable you to say as Hamlet did, “what a piece of work is man!—how infinite in faculties!—in form and moving, how express and admirable;”—and to add with Young,

“How passing wonder, HE who made him such!”

And yet, this being, with all the wondrous endowments that justly entitle it to be called a microcosm, is formed by its great Creator from

a germinal spot so small, that compared to the stature of a man, it is nothing. That Almighty hand, which with such simple means, can accomplish such mighty ends, which can, at pleasure, mould the same elemental carbon into the dirty charcoal that blazes in our furnaces, or crystallize it into the brightest diamond that ever glittered as an imperial diadem, which can from the same siliceous matter form the emerald that adorns the brow of beauty, or the clay that her feet may tread upon, can, from a mere vitellary point buried in the ovarian stroma, evolve a brain and nerves and muscles and cartilage and bones and ligaments and vessels and viscera and everything that enters into the structure of the tissues that compose the living, acting, sentient body.

Have you ever thought sufficiently of that?

And here let me introduce an idea on which I wish to dwell, and to which I have already alluded in speaking of the hand. Do you ever devote your thoughts to the objects around you the consideration they deserve? Do you ever think of them at all? Do you, when you light a lamp, ever look at the flame, and wonder what is its mysterious nature, and how it grows so rapidly that it is capable of consuming a whole town in a few hours? Do you, when you take a glass of water, feel amazed at the fact that it can be congealed into ice by cold, or converted into vapor by heat; that it is susceptible of decomposition into two gases, of them the chief agent of combustion, and the other highly inflammable; that it not only flows through our vessels, but is the motive power of our steam engines; that its home is in the airy rainbow, in the fleecy cloud as well as where the fountains are gushing and the billows foaming? Does it ever occur to you that, as the earth, on whose surface you dwell, is obliged to traverse in its orbit around the sun every year, the orbit of a comet whose radius is 97,000,000 miles, you are flying through the realms of space at the inconceivable velocity of nineteen miles in a second of time? Is it not merely when your attention is aroused by some curious inquiry, or some singular statement that you think of these things as you ought? I propose,—to give you some illustrations,—I remind you of the fact that respiration is carried on during sleep just as regularly as when we are awake, and that I ask why we do not stop breathing when the brain is in a state of unconsciousness and the will is wrapped in the silence of slumber. Suppose I ask why a fish cannot breathe as soon as it is out of water as in, or even better, or why the crystalline lens in the eye of a fish is spheroidal instead of being like ours, plano convex. Suppose I ask what kind of a musical instrument has produced my voice since I have been speaking, a stringed or a wind instrument, an organ pipe or a reed. Or suppose I inquire how it is that

alks on a ceiling, or how the common flea jumps distance two hundred times its own length. Observe, I only propose such questions as a little thought or study may enable any one to answer, leaving to more speculative minds than ours, inquiries which lead to nothing but conjecture, as for instance, in regard to the action of the gastric juice. This fluid, which is the great solvent of the food taken into the stomach, possesses the power of the strongest acids (one of its constituents being hydrochloric acid) and the most caustic alkalies, and will digest the toughest substances introduced in from three to five hours. Now with the knowledge of this fact, naturally arises the question, why does it not dissolve the mucous and muscular tissues of the stomach itself. We know that it does corrode the mucous membrane of that organ after death, and we therefore trace its preservation to an inherent *vital principle*. But what is *that*? It is something of which we know nothing, and hence, such an explanation is about as lucid and satisfactory as it is to account for single vision with two eyes by saying that corresponding parts of the retinae are accustomed to act in concert, or to explain the fact of our not seeing objects upside down by saying that it is entirely educational. But this is all verbiage; it is nothing more than seeking in the intricacies of language, a concealment for our ignorance. We have two lenses and two optic nerves, and no man can tell why we do not see two images of every object we look at. And those crystalline lenses, according to the laws of optics, and founded on theory and verified by experiment, produce an inverted image of every object, just as the lens of a camera obscura, and no man can tell why it does not *seem* to the *mind*, inverted. A person might as well attempt to tell why the olfactory nerves cannot transmit to the brain the sense of taste, or the olfactory nerves the sense of touch; why the mammary glands cannot secrete milk as well as milk, or why the salivary glands cannot secrete tears as well as the lachrymal; he might as well try to account for the mysterious workings of that wondrous power of attraction in what is called magnetism, or to explain the reason of the separation of a ray of light in Iceland spar, known as double refraction. If any one thinks himself capable of solving these mysteries. I should like to ask him what is the cause of that strange phenomenon, the Aurora Borealis, and to inquire why the ladies have no beards! There are things utterly beyond our conception, and we must therefore be content to trace them to the Great First Cause with whom we must rest content. Yet they impart a valuable lesson, for they do not impress upon us the infinite depth of a wisdom we are too feeble to comprehend; they lead us to say with Paul, "how unsearchable are his judgments, and his ways past finding out!"

But I have been led somewhat off the track. I meant to say in continuation, that in the former case, a little investigation will enable you easily to trace results to their causes. In regard to the peculiar structure of the eye of a fish, for instance, it will readily occur to you that rays of light in passing from air into water, as they are media of different densities, are refracted or bent in the course, and that if the lens were no better adapted to that refrangibility than our own, it would be intolerable. Again, in regard to the voice. It would not take a second thought to convince you that the larynx with its connections is a *wind instrument*. But what kind of a wind instrument? A musician will tell you that the compass of a well cultivated bass voice on the diatonic scale, ranges from F to C. Now an organ pipe to produce the lowest note of the bass voice, the F, must be sixteen feet in length. A human wind-pipe sixteen feet long would be extremely inconvenient. It is therefore not an organ pipe. Then the lungs which act as bellows, send the air *directly up* through the trachea. In a flute, the air is blown in at the side, and moreover as the sound is produced by the vibration of the column of air in the tube, the pitch of a note will depend on the length of the column. It is therefore not a flute. And thus any one might continue to reason.

I have said thus much to show you that the facts which are calculated to awaken attention by their singularity, have that effect, things that are more commonplace, pass by unheeded. We do not give them a thought for the very reason that they are common and that we are accustomed to them. Yet, when examined, they will be found none the less worthy of regard, and none the less calculated to inspire us with admiration of their Creator. If we were to live to the age of manhood and then for the first time see the light and feel the heat of a fire, we should be filled with as strange surprise as ever affected the bosom of the barbarian prince, Le Boo, during his visit to England, or of Caspar Hauser, when he was dismissed from the prison where he had been immured from infancy. One who has never beheld any of the beautiful experiments of Chemistry, will be exceedingly astonished if he sees a bit of phosphorus, after being placed under water and having a stream of oxygen poured upon it, burst into a flame and burn brilliantly. The idea of fire burning in water is to him a perfect anomaly, yet there is nothing in it that is strange to the chemist, or that is at variance with scientific principles. It is obvious, then, that our inattention to those things with which from daily acquaintance we are exceedingly familiar, arises from the effect of habit. "not," as Sir Charles Bell says, "from an unwillingness to contemplate the superiority or dignity of our nature, nor from an incapacity of admiring the adaptation of parts."

We are prone, too, to be carried away by anything that borders upon what we consider sublimity, by works that are extended upon a large and magnificent scale, while matters of far less magnitude, and apparently trivial, are unnoticed or unthought of. Now you will certainly agree with me in saying that this is not as it should be, when we remember the words of the poet :—

“There is religion in a flower ;
 Its still, small voice is as the voice of conscience,
 Mountains and oceans, planets, suns and systems
 Fear not the impress of Almighty power
 In characters more legible than those
 Which he has traced upon the tiniest flower
 Whose light bell bends beneath the dew drop's weight.”

Indeed if there is any difference in their respective claims upon our serious attention, and I were permitted to reason by analogy from art, I should be disposed to decide in favor of the world of wonders that microscopic research has revealed. We are naturally apt to regard the pyramids of Egypt with a feeling akin to awe, and wonder how the blocks of stone used in building them, so immense that one, if broken up, would build one or two modern churches, were transferred from quarries two hundred miles up the Nile. But would this be anything that modern science and modern art could not accomplish? Why, gentlemen, if we had enough men and a sufficient capital, if we had the resources of the ancient Egyptian kings under our control, we could raise one of the pyramids from its base, carry it across the Atlantic ocean and plant it on one of our Western prairies! I am well aware that to those who are not familiar with the modern applications of the mechanical powers, this sounds like the veriest gasconade, but those of you who are conversant with mechanical philosophy, know that it is no exaggeration, inasmuch as it would require no new powers, but merely an extension of those already known, upon a scale of extraordinary magnitude. Some of you may remember the American artist who was treated with such coldness and even contempt, while in London, until he produced an engraving whose exceeding delicacy at once gained him an enviable rank in his art, and an entrance into the grandest mansions in the kingdom. It was the Lord's Prayer concentrated within a space so amazingly minute, that few eyes could discern the letters without the aid of a magnifying glass. But what would you think of an artist who could paint in a space no larger than the retina of the eye, a picture that would accurately include the wharves and shipping and buildings of a large city, or a landscape that would reach as far as from the summit of Mt. Washington to the Bunker Hill Monument? And yet God can paint such a vast area on half an inch of the optic nerve's expansion with perfect accuracy. Think of that. And that painting, or at reflection, is not permanent, but changes with every change in the angle of vision, with every

glance of the eye, so that we have thousands of impressions there every hour of our waking moments. Is such a thing as this unworthy of our attention? Then when we examine by the aid of a microscope the animalculæ or “animated atoms” that exist in the water we drink or the air we breathe, we find them so exceedingly minute, that to use the language of an eminent physician “hundreds, if not thousands, may revel on the point of a needle, and the

‘Tear that flows down beauty's cheek,’ if examined, would be found replete with animal life in hideous forms—atomic monsters devouring each other; yet each of them has its circulating, assimilating, sensitive, and muscular system. Surely these things are not too insignificant to merit our consideration.

But do you seek something more tangible than such microscopic beings? Nature presents a field for investigation as varied as it is extensive. Its extent is not merely limited by the bounds of our senses, our intelligence, our progress in knowledge, for there is between us and that boundless ocean which is written, ‘Thus far only shalt thou go, the rest is beyond thy ken,’ a vast deal that the most comprehensive mind will never grasp,—and as an example of its *diversity*, I may remind you that among the millions of the human race, though the organization is the same in all, you will not find two whose forms, whose physiognomy and whose dispositions are precisely alike. Yet with all this diversity, there is at the same time such a uniformity and simplicity in her operations, that they may all be arranged in three departments, each of which respectively presents claims upon our attention.

And first in rank is the animal creation. Not to appreciate the divine wisdom which is exhibited in the structure and habits of animals does not require the learning and research of a naturalist like Cuvier or Buffon. Who can fail to admire the ingenuity that is displayed in the adaptation of their structure to their mode of life and the climate in which they live? Who can fail to perceive traces of a superintending Providence in those instincts which tend to their preservation and their welfare? A naturalist by his habits of closer observation and more minute analysis, may clearly perceive many things of exceeding interest that would escape a cursory view, but it is not necessary to be able like Audubon, to say of every bird we meet, that it belongs to a certain species, to a certain genus of such a class and such an order, nor like Agassiz, on being presented with the bones of a vertebræ of a fish, to tell at a glance, to what kind of a fish they belonged. A mathematician may contemplate with amazement, the extraordinary instinct which leads the bee to construct hexagonal cells for its honey,—a form, of all forms, be

adapted to the purpose. An architect may examine the curiously interwoven nests of birds, or the still more curious habitations of beavers, and while he admires their neatness, convenience, regularity and solidity, candidly admit that considering the few instruments and limited means of these builders, their works far eclipse his proudest triumphs of art. But there is enough that is obvious to the most casual observer, to render the foot prints of the Creator visible. He sees in the vast multitude around him, from the Mammalia of which himself constitutes the head, down to the Infusoria, a chain of beings whose links descend by almost imperceptible gradations. He sees that each class has an appointed race to run,—a destiny to fulfil, and that to do so, they are provided with every requisite, that they have incitements to action, instincts to discern the proper course of action, and faculties wherewith to perform their duties. He sees them in all things following out the immutable laws of their being, obtaining and preparing their food, constructing suitable dwelling places and perpetuating their species, each after his own kind. He sees that they are provided with means of defence, as well as instruments of offence, that they have the means of procuring what is needful, and that many are endowed with qualities that render them serviceable to man, and that these beings are diversified according to their several necessities, that strength is given to the horse, swiftness to the stag, sagacity to the elephant, cunning to the fox, agility to the tiger, venom to the serpent, stings to the insect, webs to the spider, fins to the fish, light to the glow worm, electricity to the torpedo, sharpness of scent to the dog, keenness of vision to the hawk, boldness of flight to the eagle, fortitude to the reindeer, and patient endurance to the camel. He observes migratory animals, when the wintry winds of the north begin to whistle, take their departure to milder, sunnier climes, and when the warm spring returns, he sees the swallow and the wild duck and the pigeon come back from the south to dwell with him again; he sees the salmon and the shad bend the rivers to deposit their spawn, and he catches the bat as it awakens from its long torpor once more emerges from its cave. He observes herbivorous animals subsisting upon the spontaneous grasses of the earth, and the carnivore feeding upon weaker animals, whose too rapid multiplication would be a source of great annoyance and mischief, while the one is furnished with a digestive apparatus correspondingly different from that of the other, the former having grinding teeth and four stomachs, while the latter have cutting teeth and but one stomach. Then he considers that birds have no teeth to masticate their food and that consequently it must be done by means of the gizzard; he observes too, that these animals and

birds breathe by means of lungs placed in the chest, and that as such an arrangement would be unsuitable for fish since they live in a different element, their lungs are placed outside of the body in the form of gills; and thus he proceeds to note the differences between the various classes of animals, and to mark by what varied and beautiful contrivances they are enabled to carry on their existence, whether it be upon the earth, in the air or in the sea.

Next in order, comes the vegetable kingdom; and here we find renewed evidences of the skill of the Great Author of Nature. We observe a great similarity in plants to animals, inasmuch as they are developed from a seed which contains like the embryo, the nutriment for their future growth, and when fully formed, they carry on the various functions of organic life, converting the products of the absorption of their leaves and roots into sap, and conveying that nutritive fluid to every portion that needs its life-sustaining power, while the flowers secrete a variety of odors, and perfect the seeds that are essential to reproduction. They are similar in this, however, that they have not sensation, voluntary motion, or mental manifestation—functions which are peculiar to animals, and though some plants, as the sensitive plant and the Venus fly-trap seem endowed with sensation, their movements will be found dependent upon irritability and not sensibility, for the latter implies consciousness.

And here again it may be said that in order to form a just estimation of the wisdom displayed in the growth and structural arrangement of the vegetable kingdom, we need not all be botanists like Linnæus. God, who can hide his mysterious wisdom from "the wise and prudent and reveal them unto babes," did not intend that his glory should be shadowed forth to men of science only. A philosopher has no more power to create a blade of grass than a peasant, nor can he any better comprehend *how* it is created. Observe, however, that this is not speaking in disparagement of science,—far from it; but remember that men of science owe their elevation above their fellows to the results of the cultivation of habits of deep reflection, of careful observation, of studious reasoning and of close reasoning, and remember too that any one gifted with brains enough to place him above a simpleton or an idiot, may do the same. Any one may *think* who will take no trouble. Any one may see that such a *diversity* as is presented in this department of nature, from the stunted moss of Greenland to the luxuriant vegetation of the tropics, could never have been designed by a finite mind. Any one may see the astonishing *fecundity*, for who has not remarked the fact that a grain of mustard seed is capable of germinating thousands of others, that a plant which

as arisen from a single seed may produce as many as 50,000 new seeds, or a tree as many new trees as it has leaves? And who that is aware how much he is indebted to it for a large portion of the food that sustains him, the raiment that clothes him, the fuel that warms him, or that prepares his food, and the utensils and furniture that contribute to his comfort and enjoyment, is forgetful of its *utility*? Who that looks upon its rich verdure and its charming blossoms when dreary winter has passed away and the pleasant spring time has come again, does not feel his bosom glow with admiration of its *beauty*? Who that has inhaled the fragrance of its flowers and partaken of its grateful fruits, is unmindful of its *blessings*? Who that, when the hand of sickness was pressing heavily, has felt the restorative power of the medicines it so bountifully furnishes, is unwilling to acknowledge its *value*? Who that has watched the unfailing regularity of its successive changes, from the opening buds of spring to the annual repose of winter, has failed to gain therefrom, an instructive lesson? What blushing maiden, as she unconsciously tears to pieces, the beautiful lilies in her boquet, would not be ready to say that Solomon, in all his glory, was not arrayed like one of them," if her attention were directed to the delicacy of their structure, the fineness of their texture, and the purity of their whiteness, instead of having a question popped of a very different import?

Are you in search of curiosities? The vegetable kingdom is filled with them. But you need not go to the banks of the Ganges to see the Banyan, with its hundreds of trunks, or to the Nile to take a draught from the famed Pitcher plant. You need not visit Java to see the poison Upas, or Ceylon, to look at the Talipot, which only once, and then on the verge of its existence, bears its leaves and fruit, and immediately dies. You need not amble to Lebanon to see antediluvian cedars forty feet in circumference, or to Brazil, to gaze upward in palms whose tops seem to touch the sky. We have enough at home to examine and to ponder over, and if we will but seek them, we shall find them. The sunny mountain tracts and the shaded dells are filled with Nature's offerings, if we will but accept them.

Lastly follows the mineral or inorganic kingdom. And what is that? Not a barren heap of stones, or a waste of sand. Not a mere mass of earth, or a rugged rock. Ask the mineralogist, and he will present for your inspection, earths and metals, and acids and alkalies, vast in number. He will show you that their properties differ as widely as day and night, for while some of the mineral substances are incombustible, others will melt like wax before the blow pipe, and while gold is so malleable that a grain of it may be hammered into a sur-

face of fifty-six square inches, and iron so ductile that it may be drawn into wire of extreme tenuity other metals are as soft as clay and brittle as glass. He will point out their infinite variety of form, from the rude unshapen mass to the perfect crystal, and their infinite diversity of colors, from the dull lustre of the leaden ore to the sparkling splendence of the ruby. He will remind you of the many uses to which art has made them subservient, how conducive they are to our comfort, how indispensable to health, how essential to life. Then go and ask the chemist in his laboratory, and you will view with delighted astonishment, the changes he is capable of effecting in these substances, transforming solids into liquids and liquids into gases, resolving compounds into their elemental constituents, and forming by the union of two simple substances, combinations unlike both in appearance and having properties belonging to neither, as for instance the water we drink and the common salt we use as a condiment,—let those wondrous transformations, those metamorphoses that fairly realize the golden dreams of alchemical visionaries; let the intensity of the lights which dazzle your eyes and darken day; let the deafening explosions that almost rupture the membrane of your tympanum be your answer. Then seek the Geologist, and he will show you how Nature in her vast laboratory with all the subterranean space for a crucible and volcanoes as scape pipes for heat, can perform the same experiments upon a scale of stupendous grandeur, causing the earth to quake and warps to hurl aloft their torrents, upheaving mountains and sinking others in the sea, and from the liquid fires in which her elementary substances are bathed, running out basalt and granite and trachyte and earths, aluminous, calcareous, argillaceous &c., to form the strata that compose the crust of the earth. He will unfold those strata from mountain summits down to the dark depths far beneath, and show you imbedded there, millions of fossil remains, from mastodon to mite, exuviae of things that once had life, petrifications that once were land or marine animals, and coal beds that once were forests. In a "piece of chalk" (that well known standard of measurement), such as that which extends from the cliffs of England across into France, he will display the remains of thousands of animals, yea, he will prove that

"The dust we tread upon was once alive," and under his guidance, you will revert to the time when the bones which have been gathered together into one vast mausoleum instead of being suffered to bleach upon the lonely hill side and in quiet valley, were instinct with animation, when the beings who claimed them "shouted together for joy," for it was when "the morning stars sang together,"—that scriptural realization of the beautiful fiction of Pythagoras, the "m

of the spheres." Thus will he teach those who think there is little in the mineral kingdom that is interesting or worthy of attention, that the earth itself is the mineral kingdom, and that the animal and vegetable creations to which she gives a dwelling place are but her own offspring, that she is the cherishing mother in whose lap they gaily sport awhile, and then becoming weary, they resolve themselves into their native dust and sink into their mother's bosom. Yet do not stop here. To ask the lapidary why he plies his busy wheel, and amid the thousand flashing forms of crystalline beauty that he will present to your gaze, you will see the peerless gems that the Revelation of St. John tells us, are to constitute the foundations of the New Jerusalem. Ask the navigator how he guides his vessel over trackless waters, and amid fog and darkness and tempest, and he will point to his magnet. A gentleman, who was sailing from Philadelphia to the East Indies, was one evening going the deck of the ship. He had sailed thousands of miles on the Atlantic, around Cape Horn and up the Pacific, and had had no glimpse of land since he had passed out of Delaware bay, many weeks before. While engaged in his reverie, the Captain came upon deck and requested him to look out his watch. He did so. "Now, sir," said the Captain, "within fifteen minutes, you will see the island of St. Paul." And so, to his utter amazement, he did, for within the given time the coast of the island was distinctly visible. And that very magnet which enabled the Captain to make such an accurate prophecy, had it been lying in the pathway of one unacquainted with its virtues, would have been passed by, as many things usually worthy of attention constantly are, unnoticed or unheeded. There is a theme for reflection in your leisure moments. It needs no comment here.

But do you seek still further evidences of God's mighty power? Make yourselves familiar with the brilliant results of astronomical discovery, and you will have yet wider fields to roam through—the fields of a boundless universe. To our limited capacities the immense bounds of our own solar system seem sufficiently amazing. Indeed, few of us, if any, can comprehend the distance of the earth from the great centre and source of light and heat, when we consider that it requires for that light, which travels 200,000 miles in a second, eight minutes to reach us. But when we consider the distance of the last planet in our system,—which, by the way, let me hope that none of you will ever call by such a faneiful and unmeaning name as Neptune; let the illustrious Le Verrier give it a name, for he gave it a "local habitation;" he revealed its existence to his fellow men, not by accidental sight through a glass which was pointed to the heavens, but by the power of numerical cal-

culatation, by long and patient observation of the perturbations of the planet Uranus, by unwearied industry in the measurement of the intensity and direction of its disturbing forces, the extraordinary result of which enabled him to see with the eye of faith the hidden stranger, and the astronomer royal of Berlin, to whom he sent a written request to point his telescope in accordance with his directions, to verify its existence by actual observation,—I say when we consider the immensity of the distance from the sun to Le Verrier's planet, 2900,000,000 miles and the time required for its revolution, 165 years, we have reason to be lost in astonishment, and yet when we look at the myriads of fixed stars, suns to other systems of planets, which twinkle throughout the universe, we may well come to the conclusion that compared with their infinity, the space occupied by the solar system is hardly worth mentioning. Bessel, a great Russian astronomer, by a correct process arrived at by great mental exertion, has ascertained the distance between the earth and some of the fixed stars,—a measurement which the genius of Copernicus and Kepler, and the far reaching minds of Newton and Herschel failed to accomplish. He has told us that the nearest of the stars is at about 600,000 times the distance of the earth from the sun. Now if we could take one step to the moon, a distance of 240,000 miles, it would take 400 such steps to reach the sun, and 240,000,000 of such steps to reach the nearest fixed star, and if it required one minute to take each step, 460 years would elapse before our journey would be completed. There is a theme to which even the pen of inspiration could not do justice; there is knowledge that will enlarge our ideas of the attributes of the Deity, beyond measure; there is a manifestation of almighty power that will overwhelm the infidel, silence the skeptic, and make him blush to think he had ever entertained the shadow of a doubt of the existence and the omnipotence of that Being, who

"Lives through all life—extends through all extent;
Spreads undivided—operates unspent."

One thing more, and I have done. I have spoken of the body which God created in his own image, but have said nothing of the immortal mind. I have told you of the clay whose moulding is but little superior to that of other animals in the firmness of its finish, but have said nothing about the Promethean fire which animates it and which makes it but little lower than the angels. I have opened to you, as it were, the portals of the temple, even to the inner shrine, but have not pointed out its presiding divinity. You have all, I suppose, heard the expression, "the house I live in" and you are familiar with the nature of this house, but can you tell what is meant by the "I," the occupant, the indweller? Suppose you take up a sku-

after gazing upon it as thoughtfully as Hamlet upon poor Yorick's, you ask, what is there in it to merit more than ordinary attention; there are but eight bones required to make up this arch, but fourteen to form the face,—not half as many as there are in the tail of an armadillo! Will not the answer come back to you as you look into its "desolate chambers," that

"This was once ambition's airy hall;
The dome of thought, the palace of the soul;
The gay recess of wisdom and of wit;
And passion's host that never brooked control."

Such is the purpose for which it is designed. It is a frail dwelling place, but its occupant is everlasting. It is a casket of little value, but it contains a gem of priceless worth. It is but a specimen of God's handiwork, while that which gives it life, and light, and beauty, is an emanation of Deity itself, and when like other earthly tenements, it will be lost amid the ruins of time and forgotten, the immortal spirit which once beamed from its lowly lack lustre eyes, will be quenching its aspirations at the fountains of eternity.

If you forget all else that I have said, forget not this.

But let me hope that you will not forget all, that you will bear with you some of the ideas I have presented, and by future reading and reflection, and observation in your leisure hours, improve the suggestions they offer. And do not confine yourselves to the books with which the sons of science have supplied you, but study nature herself. Like a kind mother, she is ever ready to put her treasures into the lap of her children. Her sources of pleasure are never ending, and they are productive of that enjoyment of which you will never weary, for when you are gay and glad, and your prospects in life are cheering, they will make the brightest things still brighter seem;

and in your darker hours, when your brows are knit by care, when you are vexed by disappointment, when you wear an expression of well founded sadness, your distracted spirit will be healed by her "tender ministrations," and tranquilized by the "soft influences" of her beauty and her harmony. Unlike mere sensual gratification, too, her pleasures never pall. The student of nature may spend the long days and the lonely nights of a lifetime in ceaseless labor, yet will he never be satiated with the fullness of knowledge, for the more comprehensive that knowledge is, the more intense becomes his enjoyment.

Stay in your library, then, and ponder over its volumes when the cheering fireside is more inviting than the chilling winds of winter and the darkness without, but when nature wears a smiling aspect, when the blackness of the tempest has passed away, and the sky is spanned with that iridescent bow whose colors no art can imitate; when the face of earth is green and lovely in the sunlight and the choral song of birds is pleasant to the ear, or when the evening sun is sinking behind the western hills and bathing the clouds that float in the horizon in a gorgeous flood of golden light, go forth in the right spirit and listen to her teachings! You will find lessons of wisdom in the smallest objects that surround you or that lie in your path way;—

"Tongues in the trees, books in the running brook
Sermons in stones, and good in everything,"

and by such study and such contemplation, you will be the better prepared to look from nature up to nature's God, to realize his goodness, to adore his perfections, to reverence his mighty power, and to exclaim with the poet,

"These are Thy glorious works, Parent of good
Almighty! Thine this universal frame,
Thus wondrous fair. Thyself how wondrous then!

